

is all a matter of education, and if they have the proper education, they will differ no whit from *real* physicians and surgeons. But isn't it funny, to say the least, that the osteopaths wish legislative sanction and support for their momentous use of the hypodermic needle? If they are osteopaths, they have no use for a hypodermic needle, nor likewise for "medical" and "surgical" societies, and if they are not osteopaths, but physicians and surgeons, then why not relegate "osteopathy" to the limbo of elective theories of therapeutics which a student may select if he is properly prepared and has a broad ground-work in the elementary sciences, in pathology, anatomy, physiology, diagnosis, etc.

The Bulletin of the New York Health Department calls attention to the fact that diminution of smallpox is always followed by a decrease in the practice of vaccination.

"The remarkable effect of vaccination was strikingly shown in Glasgow in 1901-2. That city had prepared an exposition at great expense, and when cases of smallpox began to be reported, realized that if something effective was not done at once the enterprise was doomed to failure. The city corporation, acting under medical advice, accordingly started a great vaccination and revaccination crusade. The entire medical profession of the city was employed in the work, and all who could be induced to submit to the operation were vaccinated. The results were most striking. Starting out with a population of 675,887, which had not recently been vaccinated, the workers within the next 15 months, vaccinated 404,855 persons, leaving only 271,032 who refused to submit to reinoculation. During this entire period not a case of the disease developed among the revaccinated, while among those not so protected there occurred a total of 1,858 cases."

Original Articles

PREHISTORIC TREPHINING OF THE FRONTAL SINUS*

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For investigation and study, new and most interesting material has been made available through the establishment of the Museum of Man at San Diego under the direction of Dr. Edgar L. Hewitt, Director of the School of American Research. This rich material of anthropological and surgical interest was obtained through an expedition to Peru sent by the School of American Research. The expedition was conducted by Dr. A. Hrdlicka of the Smithsonian Institute. The material was carefully gathered from the ruins and ancient cemeteries.

While studying the nasal accessory sinuses of the skulls in the Museum I came across one of undoubted trephining of the frontal sinus. This gave the incentive, and a careful search through the entire collection resulted in finding two more with trephine openings into the frontal sinus.

The study of these specimens, as well as the review of the literature, was most interesting to me and believing it would interest you accounts for this paper today.

In presenting this subject, I realize that I am asking you to consider something of the dim and misty past rather than following the usual habit of this section of considering advances of the present. I make no claims of authority on prehistoric trephining. I am convinced that many factors connected with this practice are problematic only and must, from the nature of things remain with uncertain solution. To modern minds, benefiting by knowledge revealed, there is a tendency to forget the wonderful achievements, under great difficulties, of those of ancient days. In reading the history of medicine one should not be content to learn only of modern medicine and surgery or even in going back to and including the wonderful scientific period of the Renaissance; but it should be remembered that prehistoric man, as well as man of antiquity, figure in the accumulated knowledge of today.

According to Parry, by prehistoric man the main theories of disease were:

The anger of disaffected spirits. Witchcraft. Offended spirits of dead persons. For the early man, who believed so thoroughly in possession by demons, and who suffered from convulsive fits or excruciating head pains, it was perfectly natural to believe, as he did, that at such times a devil possessed him and was trying hard to make his escape. When the pain in the head was unbearable he believed that the disaffected spirit was trying to make his exit at this particular point and called for the assistance of his fellow man to help release this devil who was boring his way out through the skull.

Broca, brain surgeon and founder of modern French School of Anthropology, seems to have believed that prehistoric trephining was done principally for convulsions, simple or epileptic.

Robert Fletcher reviewed the literature to 1882 and concluded in part that: The large number of perforated neolithic crania exhibiting cicatrized edges establishes the existence of a custom of trephining. That the purpose is doubtful but, from analogy, would seem to have been for the relief of disease of brain, injury of skull, epilepsy or convulsions. That the operation was probably performed by scraping; possibly by a series of punctures. That it was likely the first was employed for children and the latter for the harder skulls of adults.

Certain authorities believe that a religious rite accounts for some of the trepanations.

No doubt in a large per cent. of those trephined for depressed fracture of the skull an anesthetic was unnecessary as the concussion from their stone implement of war causing the fracture as well as the effects from the fracture compression was sufficient, if operation were done at once, to obliterate the pain sense. In the literature I have found no mention of the use of an anesthetic prior to the tenth century A. D. but prob-

* Read before the Forty-ninth Annual Meeting of the Medical Society of the State of California, Santa Barbara, May, 1920.

ably alcohol or herbs having a desensitizing effect were in use at the time in question. The stoicism of the Indian, coupled with his burning desire to get rid of his devil, no doubt insured co-operation. Those recovering from the operation were recognized as heroes. When a person died, upon whom trephining had been done, it is believed his skull was in great demand. There is evidence that the rim of the trephined opening was removed and divided into several pieces having healed edges and that each piece was perforated and suspended round the neck as an amulet to defend the wearer against the disease for which the dead was operated upon.

The first skull of this kind to which the attention of scientists was drawn was discovered by M. Prunieres in the year 1868 in a dolmen near Agieres. Since this date many specimens have been found and much written upon this most fascinating subject.

Probably MacCurdy of Yale University, who reviewed the subject in 1918, best gives the present views. He concluded that: "Trepanation was seldom resorted to for the purpose of removing diseased bone. That in 28 per cent. of the cases it was to relieve depressed fracture, while in a large majority of the instances the operation itself obliterated all trace of its cause, or else the cause was not of such nature as to effect the osseous system." To brain surgeons, for some time, prehistoric trephining has been an absorbing field of study. But as far as I know the reports up to date have been of no special interest to the rhinologist. A careful review of the literature indicates that specimens of prehistoric trephining of the frontal sinus have not yet been reported.

Wonderful strides have been made but it is interesting to note that there has been less than a century of investigation into man's antiquity, and intensive investigation covers but a generation or so. Probably in a surgical way the most interesting thing that has been brought to light is prehistoric trephining.

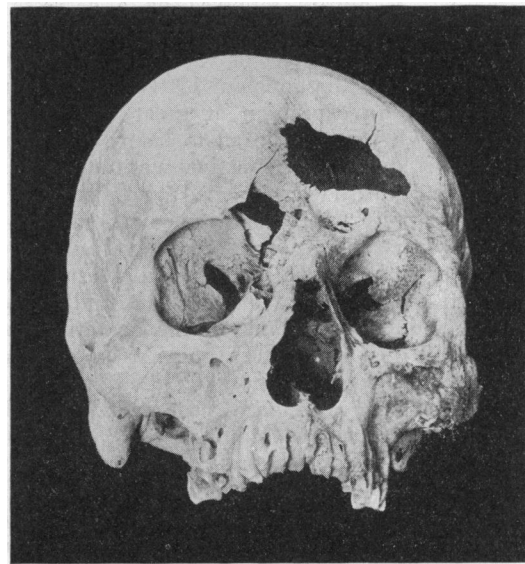
The best modern authorities first mistook true specimens for openings made in the skull by violence or disease. It remained for a noted American anthropologist, E. G. Squier, to produce, in 1886, the key specimen through which the scientific world came to truly grasp the fact of prehistoric trephining. This specimen was found in an ancient cemetery in Peru, and later exhibited in Paris. Broca agreed with other authorities that "the specimen was undoubtedly one of prehistoric trephining as the opening could have been made in no other way (Mitchell). In previous specimens there had been an element of doubt as to whether they were unquestionable examples of trephining. A view of an illustration of Squier's specimen is herewith presented.

It should be remembered that the neolithic, or late stone age, in Europe, dates farther back than that of Peru, where Indians are known to have used stone implements of war in comparatively recent years. The San Diego Museum has one trephined neolithic skull discovered at Lovosice, Bohemia, by Prof. I. Woldrick, who collected

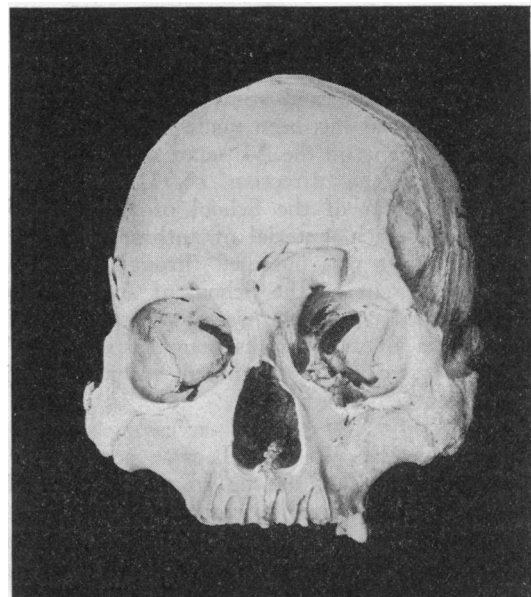
skulls in Bohemia in 1913 for the Panama-California Exposition. The hole is through the right fronto-parietal. This specimen is partly fossilized and much older than the Peruvian skulls.

Of the several hundred specimens now available for study a large per cent. came from Peru where the art, obviously, had reached considerable popularity and had been fraught with no meager degree of success as testified by the number of cicatrized skull openings showing recovery from the operation and healing of the bony wound. Specimens have also been found in France, Russia, Austria, Poland, Bohemia, Italy, Portugal, and the Island of Teneriffe as well as in Bolivia and Mexico.

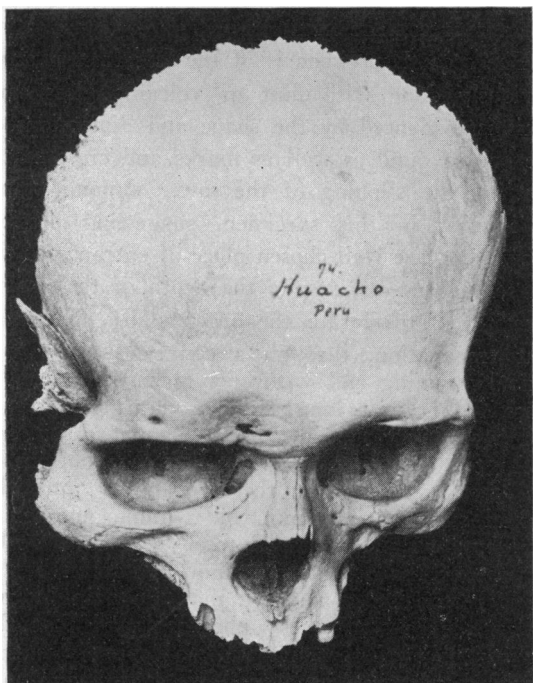
The openings were made in several different bones of the skull but according to the literature



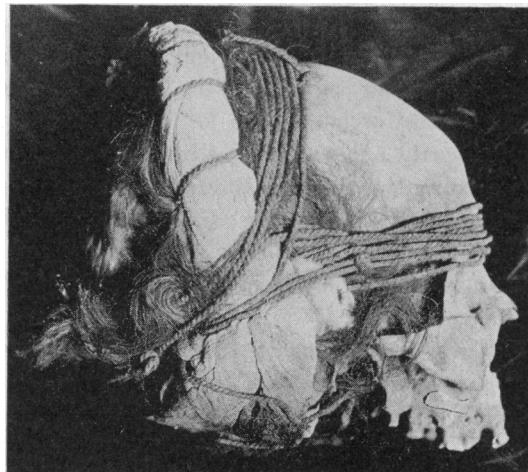
First Specimen (254, Cinco Cerros, Peru). Surgically and Pathologically Interesting.



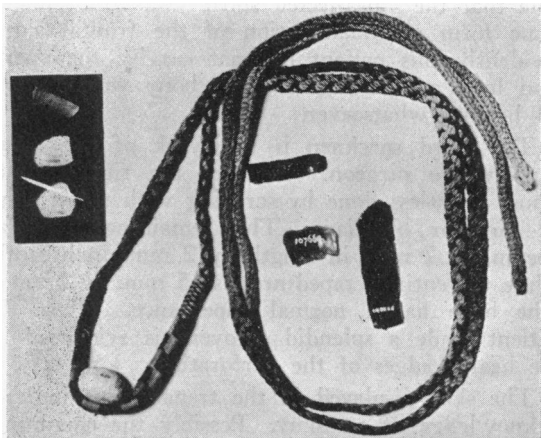
Second Specimen (288, Cinco Cerros, Peru).



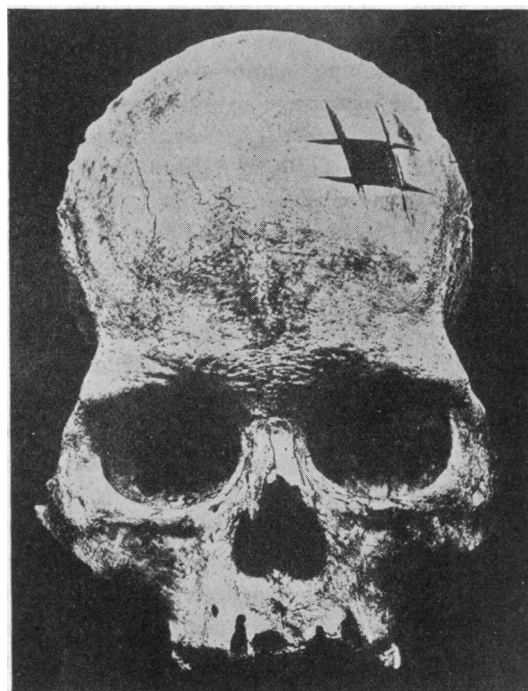
Third Specimen (74, Huacho, Peru).



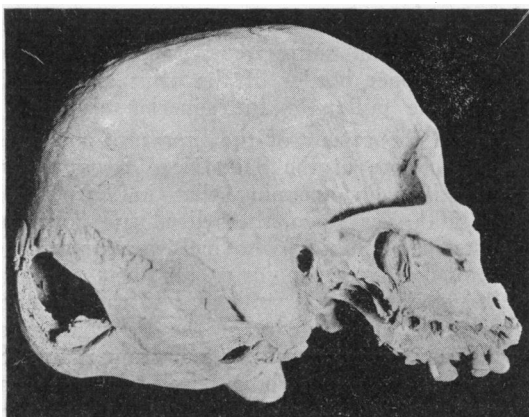
658. Lomas, Peru. Prehistoric Bandaging. From 1200 to 2000 Years Old.



Prehistoric Sling and Surgical Trephining Instruments.



Squier's Specimen.



Amulet Partly Removed.

the parietals were most often chosen. Of the sixty-three specimens in the San Diego Museum thirty-six are of the parietals—the right and left about equal. Assuming that any large per cent. of these were done to relieve depressed fracture from the stone hammer, and that the majority of the population were right-handed, the left side of the skull anteriorly and the right side posteriorly, would have been the points of attack. There are about an equal number of trephine openings on each side of the skull. This suggests that what fractures there were in the collection were largely produced by stones thrown by hand or sling.

It is said comparatively few trephine openings below the hair margin have been found. In the San Diego collection there are twenty-one tre-

phined frontal bones, ten of which are below the hair margin. Of the twenty-three posterior trepanations, eleven are on the right side and all are of the posterior aspect of the parietals, except three of the occipital—one of which shows an amulet partly removed. (See illustration.) Of the entire collection about one-fourth of the trephine openings show healed edges. The subjects having the frontal sinus trephining were Incas and it is estimated that they lived somewhere from 1200 to 2000 years ago.

To exhibit and report these specimens is the purpose of this paper.

In the first specimen I wish to report there is a complete irregular perforation 23 mm. by 44 mm. through the left frontal bone. From the lower border of this perforation there is an extension downward removing the outer plate of the frontal sinus. This extension is 20 mm. broad above; 19 mm. from above downward, with due regard to saving the superior border of the orbit. Obviously, the operation in this case was done with flint or obsidian. The entire scraped area, including the perforation, is 63 mm. by 76 mm.—this is exclusive of about 10 mm. of the lower portion of the sinus exposure. There is a perforation through the inter-frontal septum but whether this is part of the operation I am not in a position to say. That this Indian recovered from the operation is indicated by the healed margins of the trepanation wound. This skull shows no erosion to suggest syphilis. The irregular surface, and the general appearance of the inside of the sinus, suggest that there was an osteitis. To determine the pathology, because of which pain resulted, is impossible. It may be that the trepanation was done to relieve a depressed fracture and the infection resulted subsequent to the operation. This theory has its appeal. Possibly the perforation of the inter-frontal septum was in some way done posthumous. To my mind there seems reason to believe that there was, in this case, extreme pain in the frontal sinus and that this pain was due to empyema of the sinus and a trephine operation through the outer wall was done; that some time subsequently an abscess of the frontal lobe developed and a second trepanation was performed. That the sinus involvement was the primary lesion is indicated by the bone pathology, the partial filling of the sinus with osteophytes, and the thickened healed margins of the trephine wound. No doubt the operator uncovered the sinus and scraped the hole through the frontal bone to provide a point of escape for the evil spirit. This was probably one of the few cases of that time, in which the medicine man saw the devil (pus) make his exit. No doubt, how-

ever, he was not looking for this visible devil and failed to recognize him.

The second specimen is of the left frontal sinus obviously done with flint or volcanic glass saw. This is evidenced by the shape and dimensions of the bony wound as well as marks and cross marks showing the slipping of the saw. Among points of interest in this specimen, suggesting possible knowledge, are well chosen place of entrance of the sinus, and success, despite the depth of the groove necessary to perforate the outer wall. The fact that trepanation, through a convex surface, was done by sawing and with such primitive saws, of necessity, meant a long, tedious, painful procedure and would surely have been abandoned by one without a determined purpose. At the bottom of the groove there are three openings into the frontal sinus—one 1 mm. by 2 mm., another 3 mm. by 8 mm., another 3 mm. by 9 mm. The purpose of the operation cannot be known but it seems reasonable to suppose that the pain in this region of the skull was unbearable and that the sufferer believed that a disaffected spirit was trying his hardest to make good his escape, and that the trephining was done to allow him to come through. One can only conjecture as to the probable pathology in this case. But it is not improbable that the "disaffected spirit" was empyema or some form of inflammation of the frontal sinus. Evidently this patient did not survive the operation long as the edges of the bony wound show no healing whatsoever.

The third specimen is the work of a skillful, conservative surgeon. It is of the right frontal sinus, doubtless done by scraping with sharp chips of flint or obsidian. The remaining irregular opening is 7 mm. in length by 2 mm. in breadth, while the entire scraped area is 15 mm. by 27 mm. The bone has a normal appearance. That the patient made a splendid recovery is evidenced by the healed edges of the perforation.

The skill displayed in the trepanations indicate a knowledge of anatomy. Possibly the communal cemetery contributed to this knowledge. It is known that ancient Peruvians were successful embalmers—indicating that they were familiar with preservatives. They did surgical bandaging—the San Diego Museum has one excellent example.

In each frontal sinus trepanation the operator spared the upper border of the orbit and thereby protected the pulley of the superior oblique.

Through the review of the literature and study of the specimens in the San Diego Museum one seems justified in assuming that in Peru, from 1200 to 2000 years ago, there lived and flourished specialists in trephining who had won prominence for themselves and popularity for their specialty. Patients probably came from afar to these leading specialists, as the majority of the Peruvian specimens have been found within a narrow radius. So once again "there is nothing new under the sun"—even including sinus specialists and sinus surgery.

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